

Selecting a Set of Rail Routes to Yucca Mountain

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Purpose

- To show how to develop a set of rail routes from a reactor site to the Caliente Corridor entry point to Yucca Mountain
 - H. B. Robinson site used for this example
- Show how, by selectively blocking critical locations, the TRAGIS model can develop a variety of routes
- Show different statistics, both within and outside of TRAGIS, to compare routes

Calculating Rail Routes with TRAGIS

- Routes calculated with both the “manifest” and “dedicated” route types
- Several nodes initially blocked
 - UP through Streator, IL
 - UP trackage rights on the BNSF line between Chicago and Kansas City is limited to intermodal trains
 - Rockwell Street, IL
 - Diverts traffic from near downtown Chicago

Blue Route from Robinson to the Caliente Corridor

- This is the standard “manifest route” type
- TRAGIS attempts to
 - Maximize the use of high density track
 - Minimize the number of rail carriers
 - Originating carrier given a preference
- CSXT, TRRA, and UP
- Interchanges occur in St. Louis area and involve a terminal RR (TRRA)



Orange Route from Robinson to the Caliente Corridor

- The “dedicated train” route type used to calculate this route
 - No preference given to originating carrier
 - Transfer penalties reduced
- CSXT, NS, and UP
- Interchanges occur at
 - Charlotte
 - Kansas City



Brown Route from Robinson to the Caliente Corridor

- Back to “manifest train” route type
- Marysville, KS blocked to divert route from Nebraska
- This sends the route through Colorado into Utah
- CSXT, TRRA, and UP with interchanges in the St. Louis area



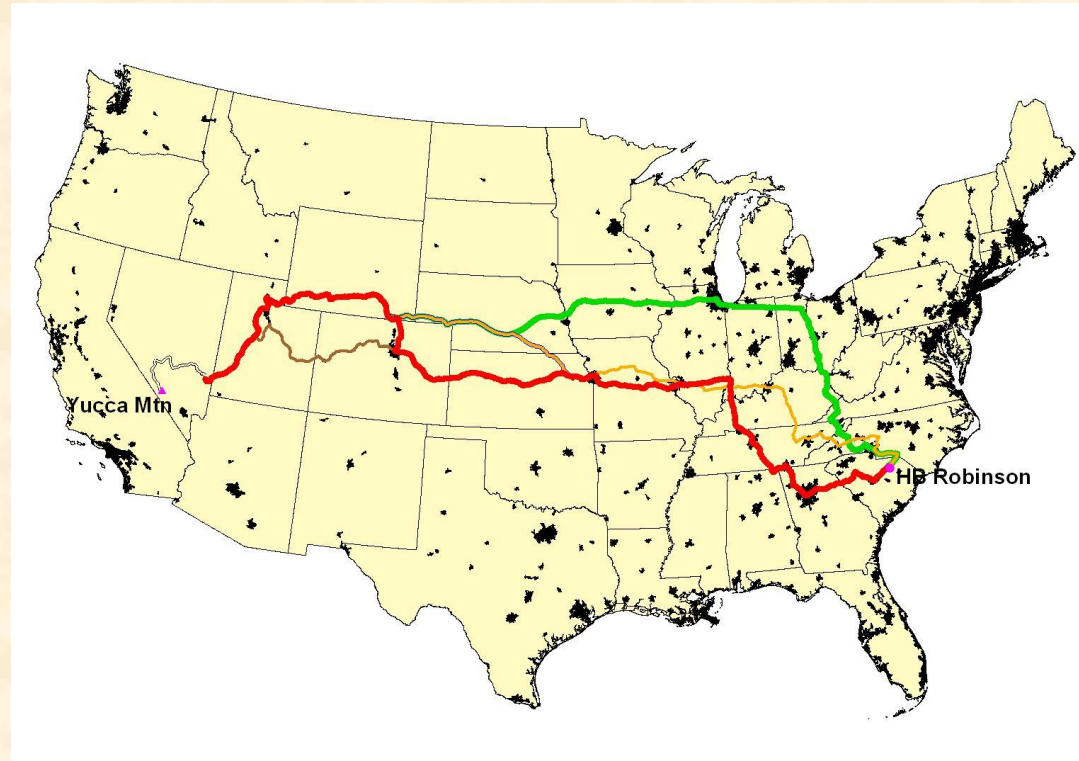
Green Route from Robinson to the Caliente Corridor

- Manifest route type used
- Dotsero, CO blocked to divert route from western Colorado
- Route passes through eastern Kentucky coal fields to northern Ohio, then west through Chicago
- CSXT, IHB, and UP
- Interchanges occur in the Chicago area and involve a terminal RR (IHB)



Red Route from Robinson to the Caliente Corridor

- Manifest route type used
- Clinton, IA and Hiawatha, KS blocked to divert route from UP line across Iowa
- This route heads to Denver then across southern Wyoming
- CSXT, TRRA, and UP with interchanges in the St. Louis area



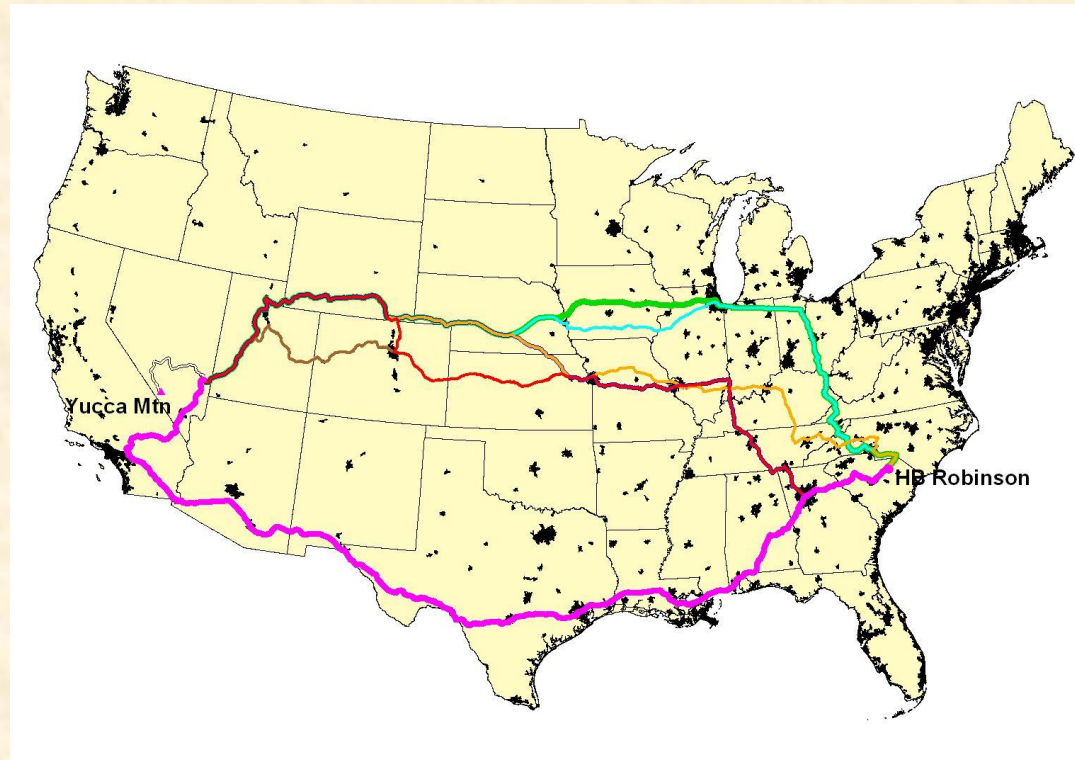
Cyan Route from Robinson to the Caliente Corridor

- Manifest route type used
- Kit Carson, CO blocked to divert route from passing through most of Colorado
- Polo, MO blocked to divert route from heading north from Kansas City
- This route is very similar to the Green Route, but follows a BNSF line from Chicago to Council Bluffs
- CSXT, IHB, BNSF, and UP
- Interchanges occur in Chicago and Council Bluffs



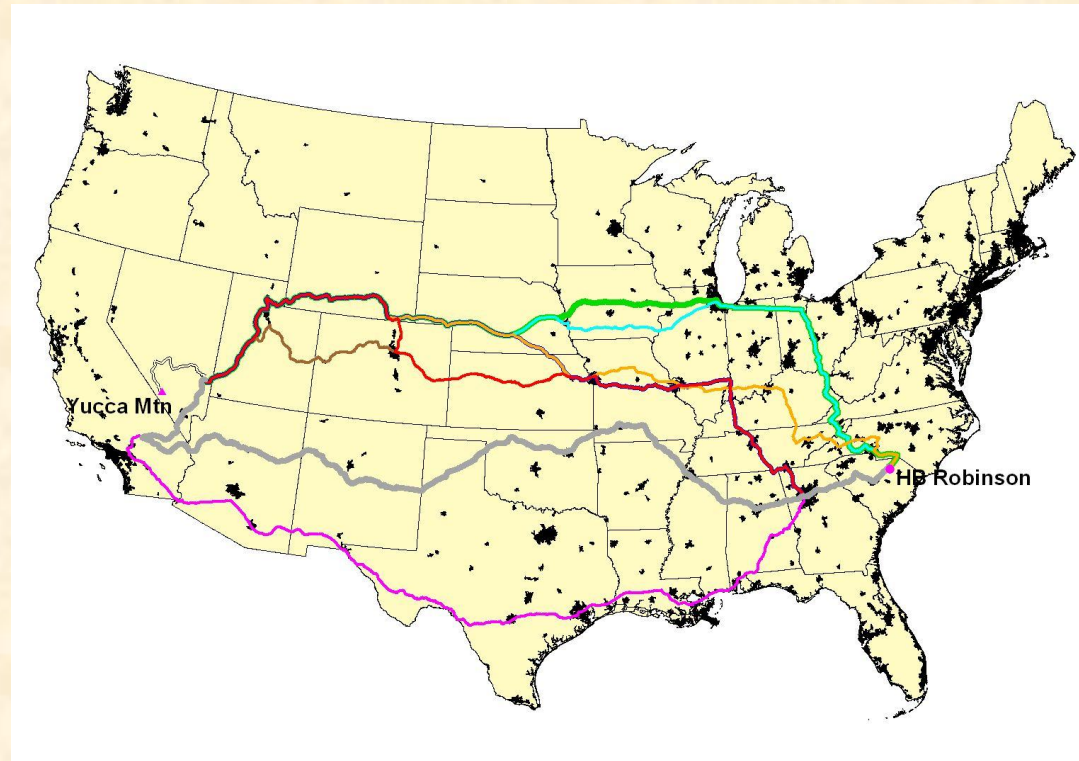
Purple Route from Robinson to the Caliente Corridor

- Manifest route type used
- Lund, UT blocked to divert route to a southern path
- This route uses CSXT to New Orleans then west on UP
- Route passes through Houston, TX and San Bernardino, CA
- CSXT, NOPB, and UP with interchanges in the New Orleans area



Grey Route from Robinson to the Caliente Corridor

- No further nodes blocked, but the “dedicated train” route type is active
- This route passes through Memphis, Amarillo, and Flagstaff
- CSXT, NS, BNSF, and UP
- Interchanges at Atlanta, Birmingham, and Daggett, CA

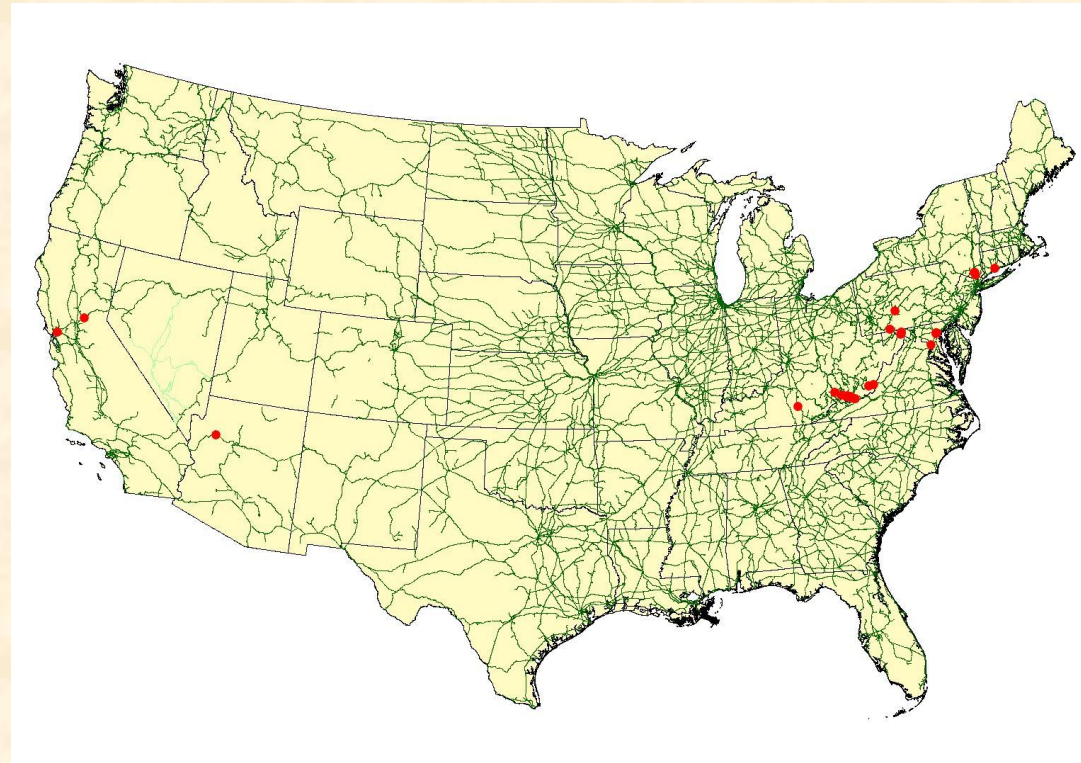


Other Routes Are Possible

- **Several permutations of the Grey Route (crossing the Mississippi River at Memphis) can include**
 - **Remain on CSXT between Robinson and Birmingham**
 - This would remove one carrier, but increase distance by 80 miles
 - **Use BNSF between Birmingham and Kansas City rather than heading west to California**
 - This would reduce the distance by 213 additional miles

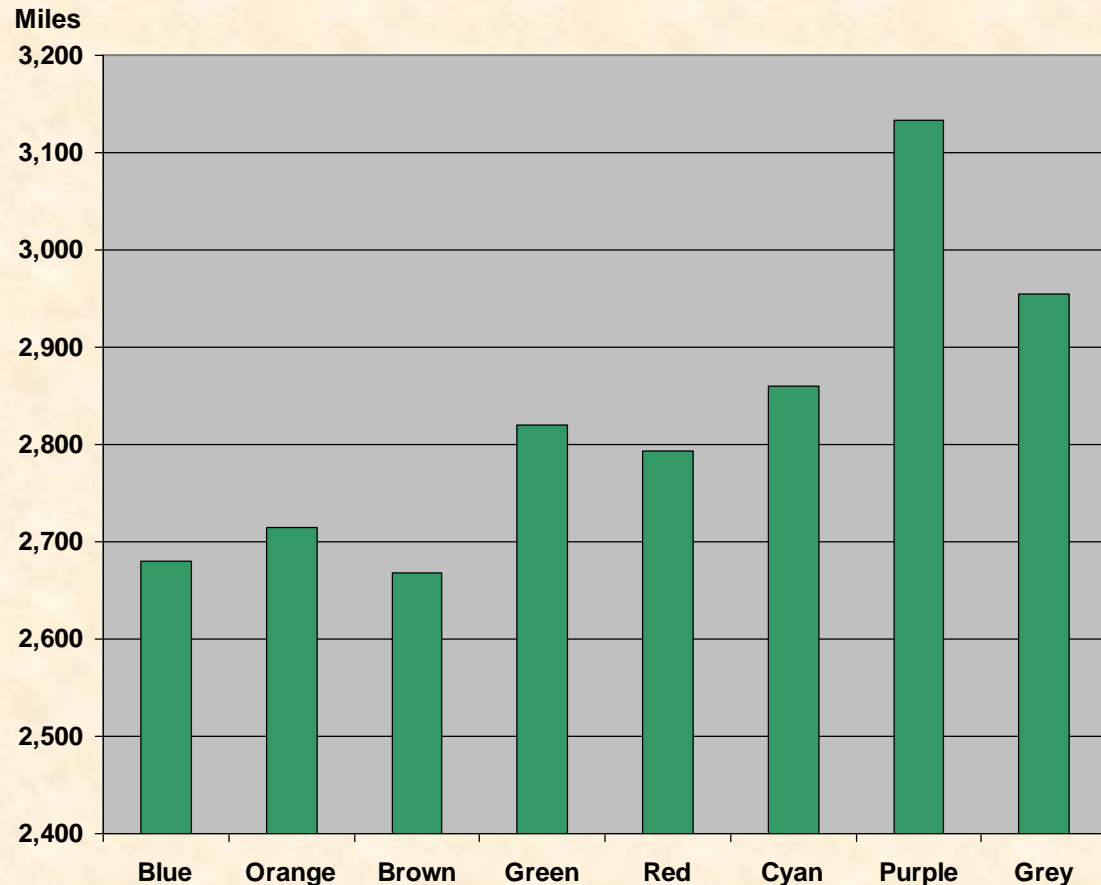
Double Track Single Bore Tunnels

- Concerns have been expressed about SNF shipments through double track single bore tunnels
 - OT-55 provides an administrative control
- Possible double track single bore tunnels are shown
- Only one such tunnel on one route in this set of routes from Robinson



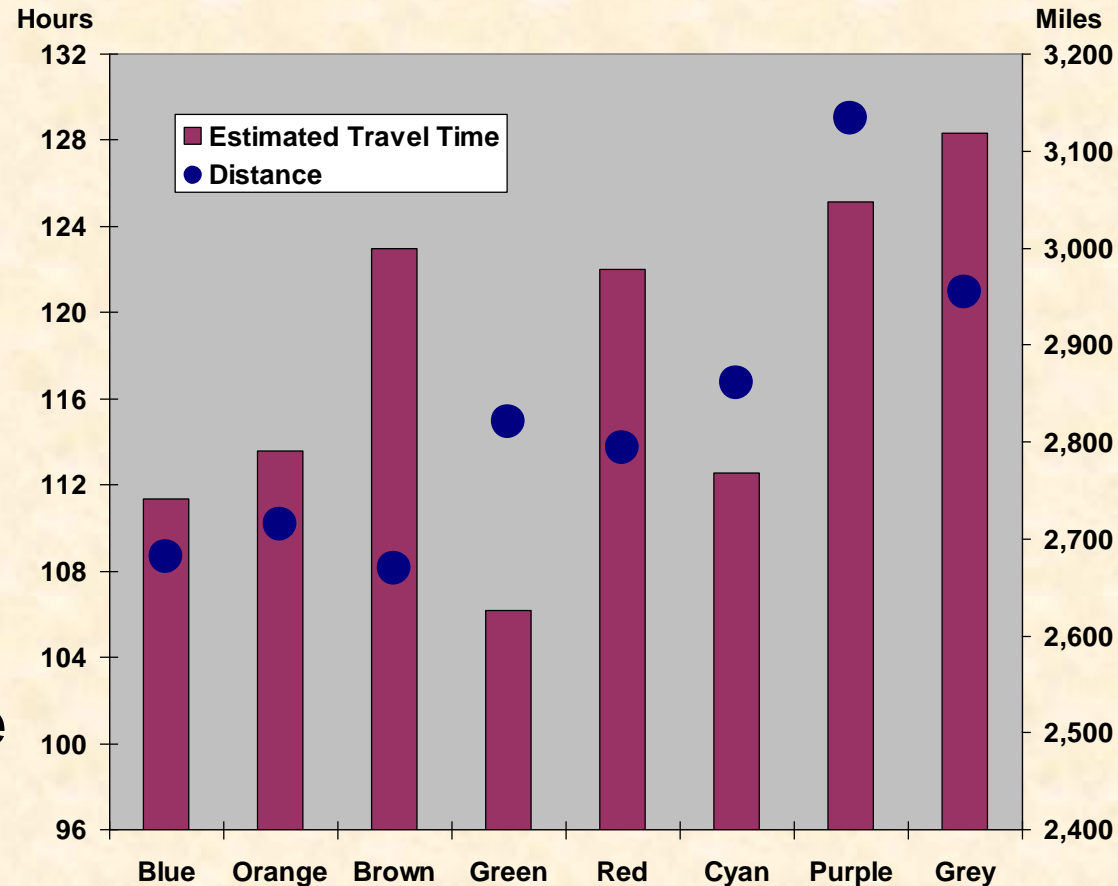
Comparison of Route Distances

- The sequence of routes generally increase in mileage
- Brown is the shortest
- Purple is the longest, at 16.9% longer than Brown
 - For most of the commercial and DOE sites, routes across the southern U.S. are longer than those passing through WY



Estimated Travel Time vs. Distance

- Relationship between distance and travel time is not direct
- Green Route has lowest estimated travel time
- Grey Route has the highest, 20.8% more

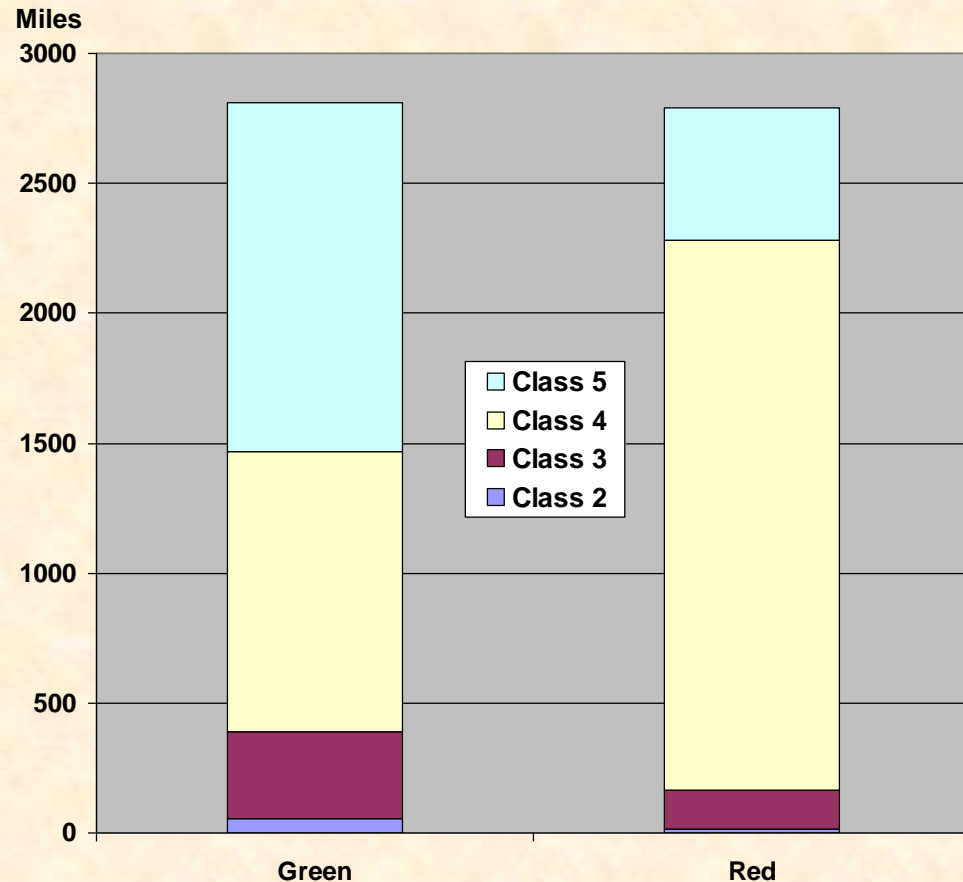


Comments on Travel Time

- **TRAGIS estimates travel time based on traffic density of a line**
- **This usually works well for most routes**
- **Exceptions are**
 - **The Green and Cyan routes run between Bostic, NC, and Ashland, KY**
 - **This line has relatively high traffic density (primarily coal), but passes through mountainous terrain with considerable curvature and grades**
 - **The Brown Route through western Colorado is somewhat similar**
- **Improved travel time estimate could be gained by adding Track Class to the rail network and use it to assist with travel time estimation**

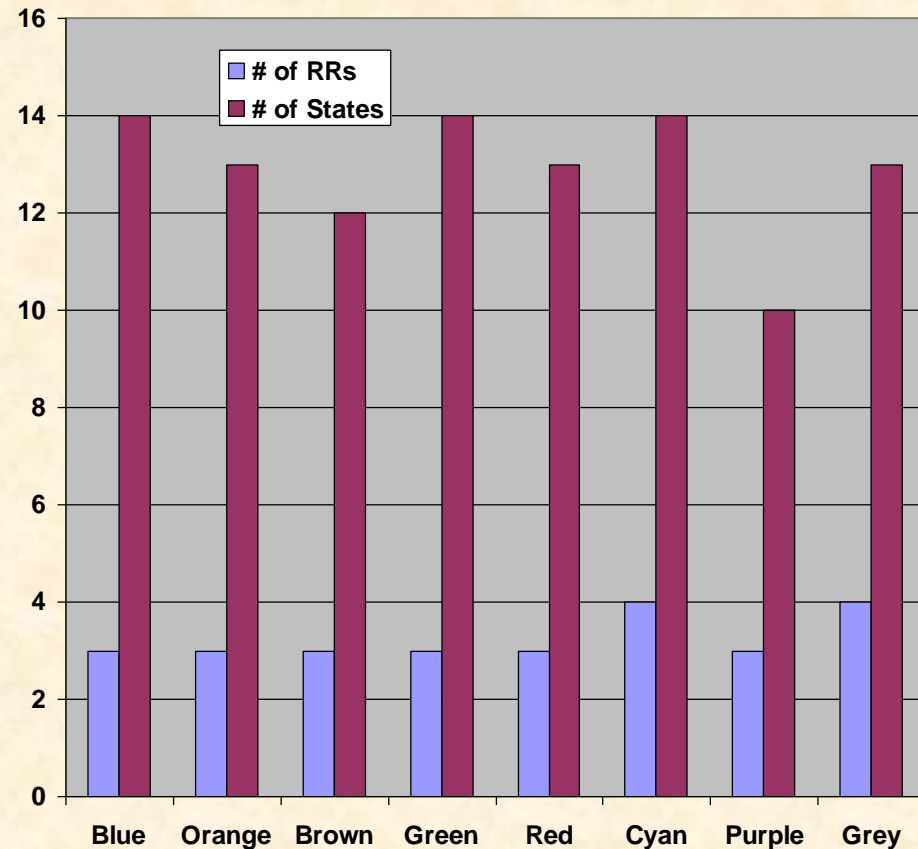
Comparison of Track Class for the Green and Red Routes

- Green Route has more Class 2 and 3 mileage than the Red Route
- Green Route has significantly more Class 5 track
- There will always be some miles of Class 2 or 3 track
- This data is not currently in the network



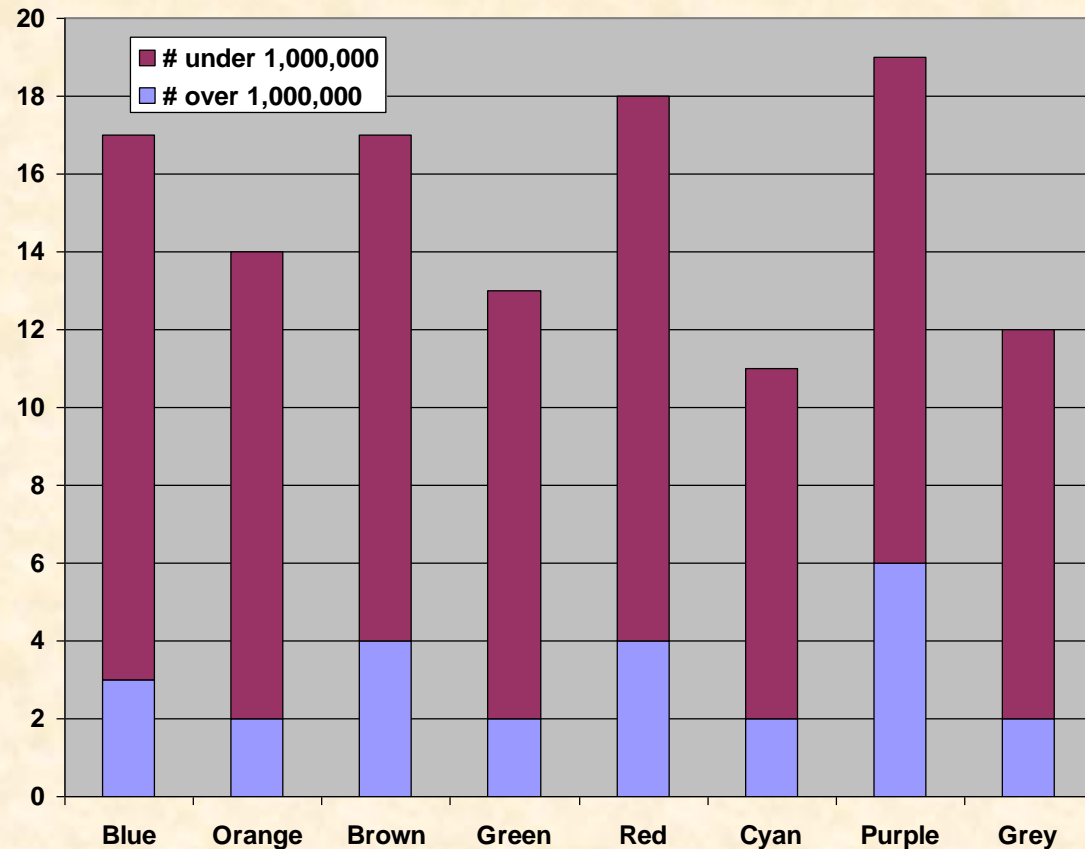
Number of Railroads and States

- Terminal railroad used on all routes except for Orange and Grey
- Purple Route crosses the fewest states
- The Blue, Green, and Cyan routes cross the most states



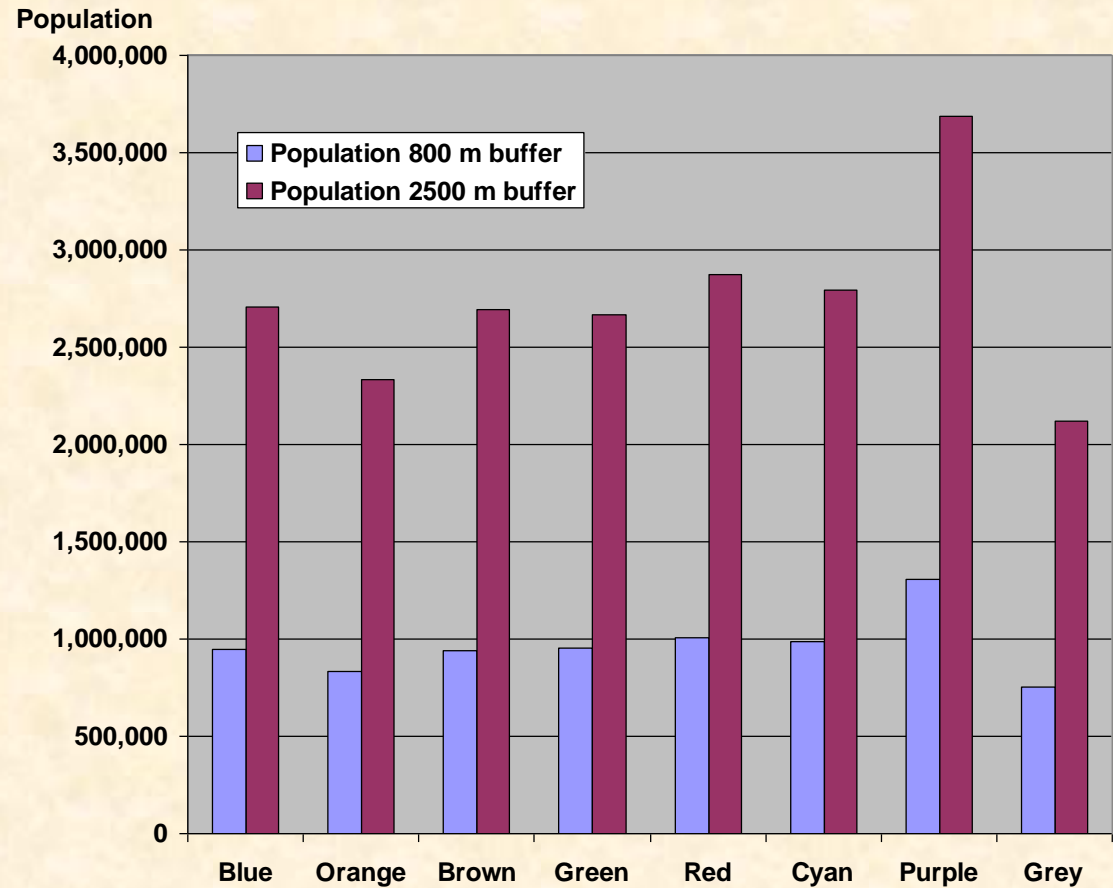
Number of Urbanized Areas Crossed by Routes

- Census defined urbanized areas
- Cyan Route has the fewest urbanized areas
- Purple has the most, with 6 areas over a million people



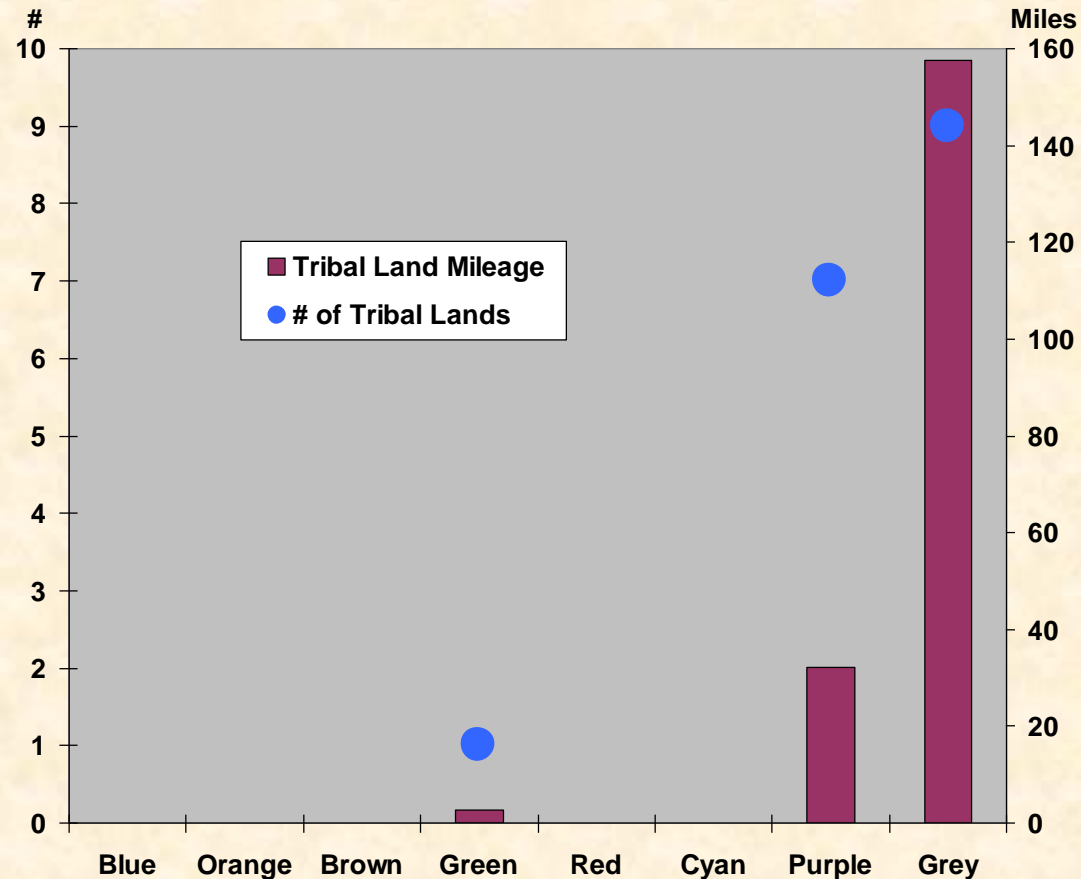
Population Within 800 and 2,500 m Buffer Either Side of Routes

- Purple Route has the highest population
- Grey Route has the lowest
- Cyan Route has the fewest urbanized areas, but has comparable population to the Red Route, which has the second most urbanized areas



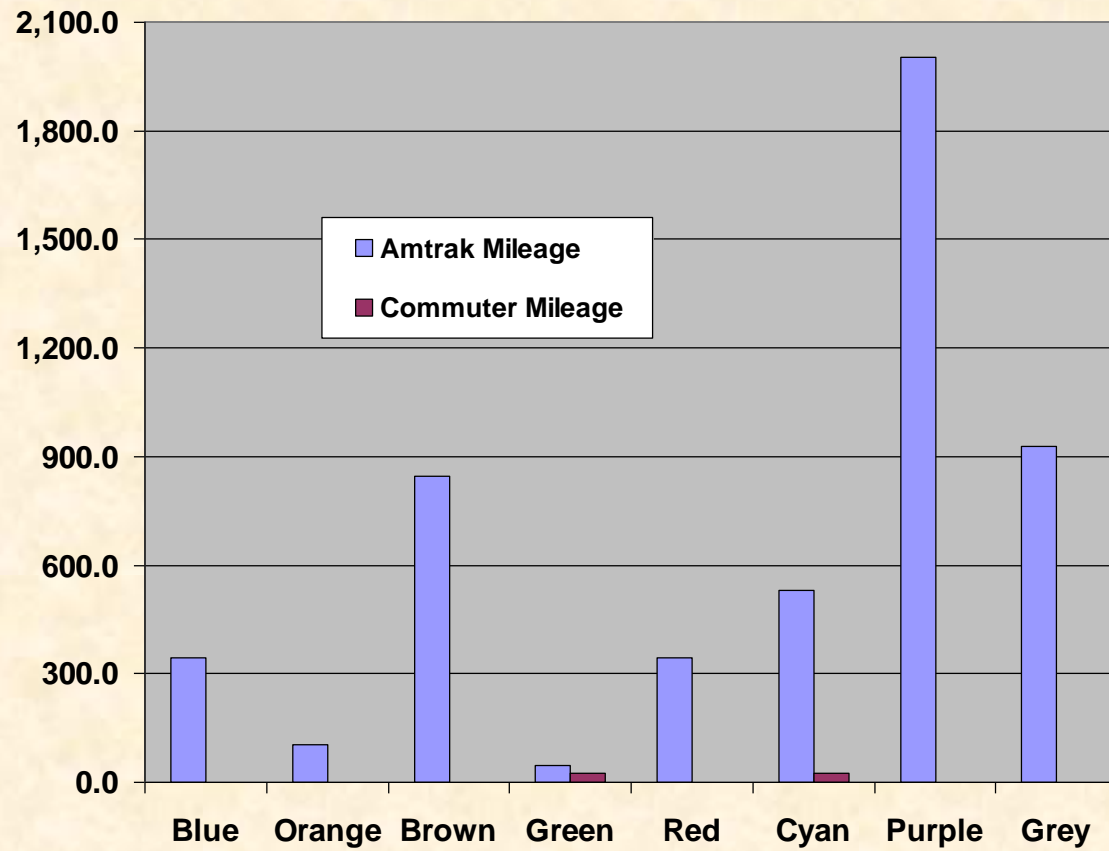
Tribal Land Along Routes

- Only three routes cross tribal lands
- The Grey and Purple routes, both which cross the southwestern portion of the country, cross the most tribal land



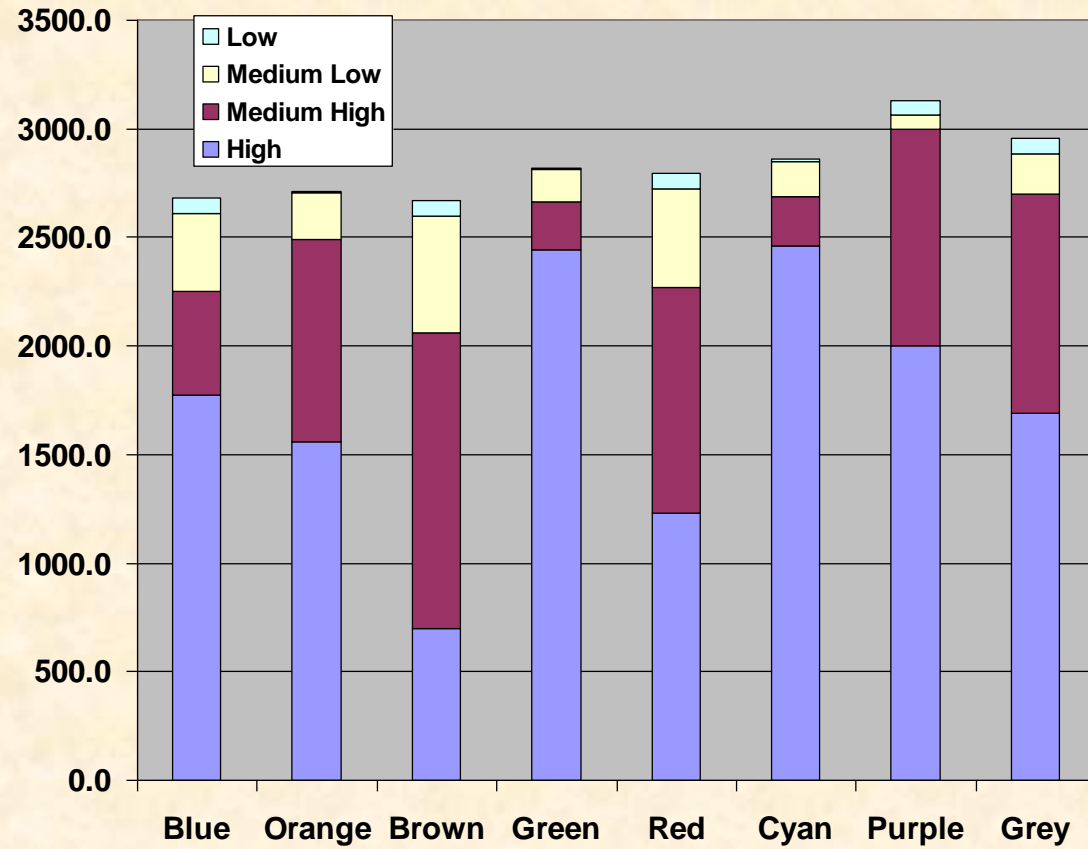
Passenger Operations Along Routes

- Nearly two-thirds of the Purple Route currently hosts Amtrak operation
- Amtrak has operations over 30% of the Grey and Brown routes
- Commuter operations exist only over small portions of the Green and Cyan routes (in the Chicago area)



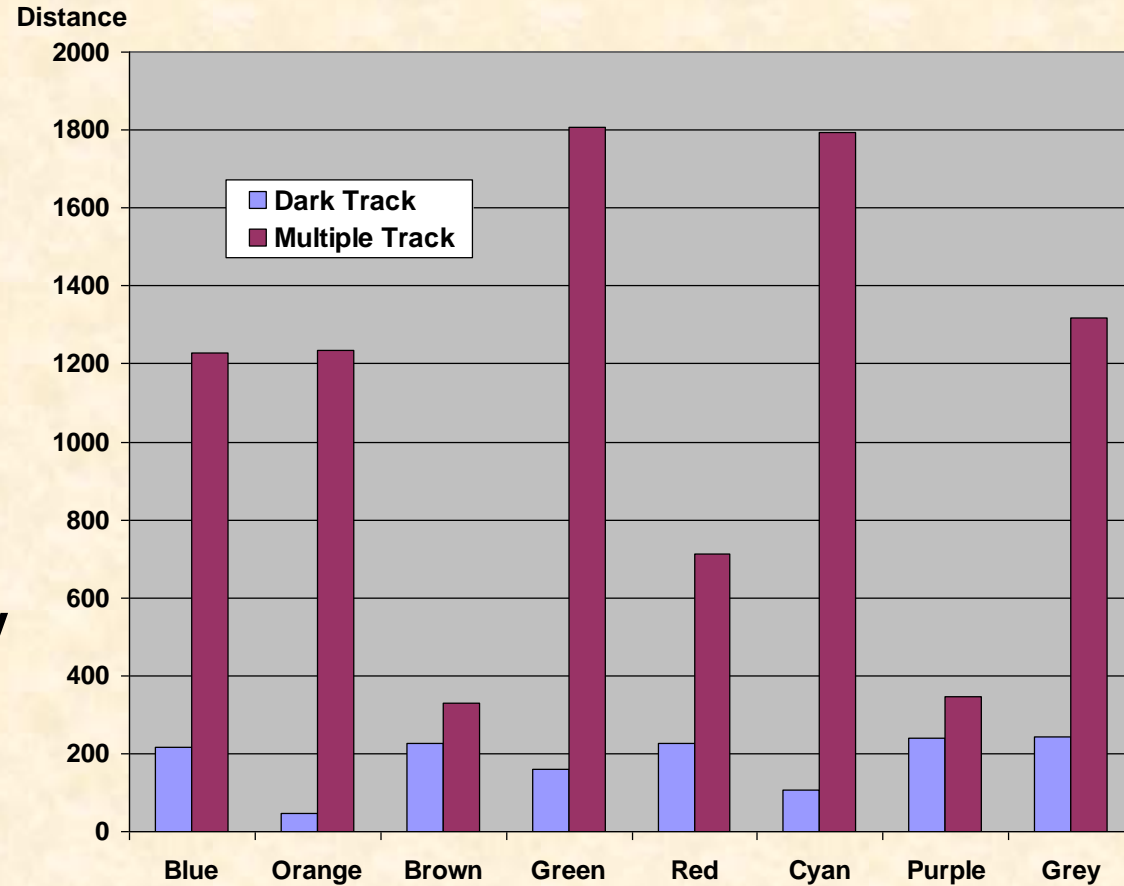
Traffic Density Along Routes

- The Green and Cyan routes have the highest mileage over high density lines
- The Brown Route has the lowest mileage over high density lines
- The low density portion of the routes occurs between Robinson and Columbia, SC



Track Characteristics Along Routes

- “Dark Track” does not have any signals
- Routes have one or two significant segments with no signals
- Green and Cyan routes have the most distance of double track
- The double track portions of the top four routes have high priority traffic that may be disrupted by DOE SNF trains



Concluding Remarks

- **Most of the data shown are in the rail network, but some of the attributes are not distributed with the TRAGIS model due to proprietary concerns**
- **The objective function in TRAGIS mimics actual railroad operations by considering distance weighted by classes of traffic density and minimizing the number of rail companies**